



Annual Reports :: Year 6 :: University of Colorado, Boulder

Project Report: Geological Evolution and Habitability of Europa

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### Project Progress

An issue crucial to understanding the potential habitability of Europa is whether the satellite's level of internal activity has remained relatively constant, has waned through time, or is cyclical with periods of greater and lesser activity, all of which represent physically plausible scenarios. If Europa's level of internal activity is high today, its potential to harbor life is significantly greater than if the satellite's internal heat sources have dwindled over time (or if they cyclically diminish to negligible levels). The record of the satellite's geology, specifically its structures (ridges and bands) is key to unraveling this issue and is the focus of the proposed study. We have implemented a quantitative method of temporally ordering Europa's geological features based on their cross-cutting relationships as mapped within Geographic Information Systems software. It allows us to group lineaments that have indistinguishable positions in the stratigraphic order. These lineaments can be treated as roughly contemporaneous, and used to investigate the changes in orientation and origin of the surface stresses through time. We can investigate both their gross changes in lineament orientation and the match between their detailed orientations and modeled stress fields resulting from the tidal potential created by Jupiter's gravity. As a test case, this method has been applied to the lineaments of the Conamara Chaos region. We find that there are some intersecting lineaments that were either truly contemporaneous or were re-activated after their initial formation. We are currently implementing a tool for quantitatively testing the match between mapped lineaments and possible surface stress fields.

### Highlights

- With the goal of understanding Europa's level of internal activity through time, we are mapping lineaments on Europa, determining a quantitative stratigraphic ordering, and comparing this stratigraphy to candidate stress mechanisms. We have implemented a quantitative method of temporally ordering geological features on Europa based on their cross-cutting relationships as mapped within Geographic Information Systems software. As a test case, this method is currently being applied to the lineaments of the Conamara Chaos region.